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HE BUILDING GAZETTE

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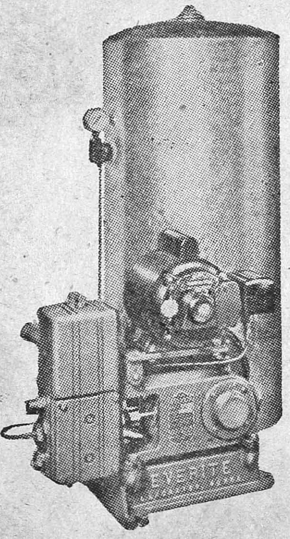

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AN INDEPENDENT MONTHLY JOURNAL DEVOTED TO THE INTERESTS OF BUILDING INDUSTRY

VOLUME I | DECEMBER 15, 1948 | NUMBER 4

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PRINCIPAL CONTENTS

5 NATIONAL RECONSTRUCTION

6 NOTES AND TOPICS

8 SOIL-CEMENT BLOCKS FOR BUILDING

12 HEALTH AND SAFETY GOVERN BUILDING REGULATIONS

13 LEARNING TO BUILD

17 METHODS OF TERMITES ATTACK

19 LAW REPORT

23 INQUIRY BUREAU

24 AEROPLANE HANGAR DESIGN

26 CONTRACTS OPEN

RESULTS OF TENDERS

27 FOR DISCUSSION

PROPOSED NEW WORKS

28 TUNNEL CONSTRUCTION

EDUCATIONAL

30 CURRENT MARKET PRICES OF MATERIALS

32 LIST OF STOCK-HOLDERS

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BUYERS' GUIDE

FOR	SEE PAGE
BOOKS	29
CONTRACTORS	29 & 31
ELECTRICAL GOODS	31
EMPLOYMENT EXCHANGE	29
ENGINEERS	31
GLASS TILES	31
HARDWARE	Inside Back Cover
MACHINERY SUPPLIES	1
MALABAR TILES	Inside Cover
PLYWOOD	31
PRINTING	2
PUMPS	1
SANITARYWARE	31
SCHOOL OF PLANNING	28
STATIONERY	31
TIMBER	1
WATER DIVINER	31

NATIONAL RECONSTRUCTION

In an attempt to devise and define by conversations the solutions to the present day problems we had a series of interviews with Dewan Bahadur L. Venkatakrishna Iyer, retired Chief Engineer, P.W.D., Madras, Dr. K. L. Rao, Designs Engineer, Ramapadasagar Project, Rao Sahib K. K. Nambiar, Chairman, City Improvement Trust, Madras, Mr. G. V. Rao, retired Sanitary Engineer of Madras, and Lt.-Col. S. Paul, Principal, College of Engineering, Guindy. Ideas sprang from all of them who see in a rather naive way the disabilities that exist for the engineering profession in this country. Discussion lasted 20 minutes minimum and 4 hours maximum. It can be reduced to the following Question and Answer form for the sake of brevity and clarity though not this was done then:

1. Are you satisfied that engineers are making the best possible contribution to the national reconstruction effort?

Answer: No.

2. In what way are they falling short of their maximum contribution?

Answer: The present system of education offers no incentive to such a contribution. Hitherto the tendency is rather to produce a host of "Utility" minds.

3. What form of co-ordination of effort in the interests of national reconstruction would you suggest?

Answer: It is doubtful whether the engineering profession as it is can be better co-ordinated. Further it is obvious that independent consulting engineers as a class do not exist in India today as in other countries, and only official engineers are on the increase.

4. What direction do you think better organization, co-ordination or liaison should take?

Answer: So far the Government has not sought technical advice from "Institutions". This suggests there must be "expert groups" who are capable enough to render sound technical advice to the Government on conflicting matters. In its absence, the Government naturally seek outside advice.

5. How then can we produce experts or specialists for our vast reconstruction programmes?

Answer: ....

Without prejudice, the Journal suggest the following remedies:

(a) The system of P.W. administration left to us by the former Government is such that everyone knows something about everything, but no one knows everything about something: so a reorganisation is the first necessity.

(b) The remuneration to the teaching staff of engineering and technological institutions are not attractive to 'master-brains' in the country: so a revision of pay is a pre-requisite; and

(c) Specialisation should be initiated by professional institutions and researches by universities.

Now taking the last point first we are convinced that a high standard of engineering practice is essential, not only over the whole field of Public Works Departments, but also in municipal and district board services, if this country is to attain and maintain the efficiency necessary for the full development of its resources. In recent years engineering has also most certainly become more complex, and the duties of engineers will call in a very special degree for such qualities of leadership (we mean in techniques) as can only be given by the best persons in the country, fully supported by the pooled experience of all the specialists. While there is only one Chartered Institution (we mean, the Institution of Engineers, India) in this country concerned with questions of engineering whose members individually have done excellent work in the past, its members, however, have been handicapped in many directions, and, in any case, cannot seek the sort of comprehensive facilities which a specialist institute might offer.

It would, therefore, be both interesting and instructive to organise active centres of such bodies as:—

The Institution of Structural Engineers,
The Institution of Water Engineers,
The Institution of Municipal Engineers, etc.

and such formations are possible for those who are now full-fledged members of various specialist Institutions.

We trust Mr. Nambiar will lead the Institute of Municipal Engineers in India.

NOTES & TOPICS

Prefabrication.

There is much misunderstanding about the word prefabrication and there is also some confusion about the terms standardisation and mass production. It would be as well to define these terms.

Most engineering products are standardised in the U.K. For instance, the British Standards Institution have issued over 150 British Standard Specifications relating to building. These specifications have for their object the improvement of British standard practice in building. They standardise the quality and dimensions of building materials. There are also the Codes of Practice which give standard methods of using the materials.

Mass production obviously means the manufacture of articles to a standard pattern. Thus bricks are mass produced. Mass production has developed because of the introduction of the machine, and has been aided by the adoption of standard sizes.

Prefabrication is a much more difficult term to define, and, in fact, the term has been badly chosen. By derivation it should mean pre-made, in which case a brick is prefabricated ; but this is obviously not the present meaning of prefabrication. Brickwork would be prefabricated if a number of bricks were formed into a panel in a workshop, and this panel were taken and erected on the site. Prefabrication really means to mass-assemble or pre-assemble.

The U.K. Ministry of Works has defined prefabrication as meaning " the formation of buildings or components for buildings by the assembly of materials or units otherwise than in their final position ".

Sand-Lime Bricks.

Sand-lime bricks, made from a mixture of slaked lime and sand, which is pressed into shape and hardened in steam pressure chambers, are cheap, durable, and can be ready for use within twenty-four hours of the raw materials reaching the works. As they are perfect in shape and uniform in size, less mortar is necessary in laying them. The sand-lime brick is normally white or grey, but colouring materials can be introduced during the manufacturing process—and made like this the bricks can be used for interior walls without plastering, as each is a smooth "facing brick". There is a British Standard Specification for this type of brick.

Lamp Changer.

An easy and time-saving method for changing electric light bulbs, and for removing broken lamp bases, without the burdensome use of ladders or staging is provided by the "Chadsey Lamp Changer". It consists of various sized rubber changer-heads, light-weight hardwood sectional-poles and a straight or angle adapter that joins the changer-heads to the poles.

The "Chadsey Lamp Changer" acts like the grip of the hand at the end of a pole and operates by sliding the rubber changer-head, which is securely locked to the pole by the adapter, over the lamp to be replaced. A couple of twists of the wrist brings the light bulb in or out of the socket.

A special feature of the "Chadsey Lamp Changer" is its ability to remove broken lamp bases which often remain stuck in sockets.

Indian Engineers Overseas.

Madras group of 9 engineers under the leadership of Mr. U. Ananda Rao, Superintending Engineer, East Punjab group of 8 engineers under the leadership of Mr. M. R. Chopra, Superintending Engineer, and U.P. group of 7 engineers under the leadership of Mr. Yadav Mohan have reached U.S.A. and are studying at first hand the details of construction works to gain practical knowledge.

Calcutta's Highest Building.

Hindustan Buildings, Calcutta's first skyscraper, is a residential building and is 139 ft. in height. The Victoria Memorial, 198 ft. high with its 16 ft. figure of victory is the highest building in Calcutta.

Bihar Bans Cinema Buildings.

The Government of Bihar, it is learnt, have issued instructions to all district officers not to issue any new licences for cinemas for a period of 2 years. The fact is that large quantities of building materials are being used for the construction of new cinema houses, while the Government's own building programme is being held up for want of building materials.

Indian Steel for Pakistan.

In accordance with the Karachi Agreement India has undertaken to supply Pakistan 64,000 tons of steel and 16,000 tons of pig-iron by the end of June next year.

Housing Board for Bombay.

The Government of Bombay has set up a Housing Board consisting of a Chairman and four members to carry out the programme of housing in the Province. The Central Government has already granted a loan of Rs. 2 crores.

Nagpur Improvement Trust.

The Provincial Congress Committee has urged the Nagpur Improvement Trust to discontinue the dismantling of houses of the poor class population and has suggested that owners of houses already dismantled be given full compensation at the present market value.

Co-operative Housing Societies: Bombay Govt. Assistance.

The policy of the Government of Bombay in regard to co-operative housing is to give preference to societies building tenements with a carpet area not exceeding 450 sq. ft.

Tansa Scheme Contracts.

The Bombay Municipal Corporation has permitted the Commissioner to enter into contracts with two engineering firms of Bombay for the construction and laying of 47 miles of pipe-line at a cost of Rs. 2,00,50,000 to carry out the revised Vaitarna-cum-Tansa scheme.

Appurtenant to Houses: Assessment.

The Madras Provincial Housing Committee has recommended that where open spaces appurtenant to houses in Madras City exceeds 20 times the plinth area of the houses or two acres, such extra spaces should be subject to taxation based on market value, and if this procedure necessitated amendments to the City Municipal Act, the same should be undertaken.

Housing Board for Bengal.

A Housing Board for drawing up construction schemes for refugees has been appointed by the West Bengal Government. The Board's functions will specifically include selection of suitable sites, determination of types of structures and execution of the approved schemes through contract.

The composition of the Board is as follows:—Dr. B. C. Roy, the Premier (Chairman), Mr. N. B. Maity, Relief and Rehabilitation Minister (Vice-Chairman), Rai Bahadur N. K. Mitra, retired Chief Engineer, E.I. Ry., Mr. J. K. Mitra and Mr. J. Ganguly, Construction Engineers (members). Mr. S. N. Bandopadhyaya, Special Officer, Works and Buildings Department, will act as Secretary.

Sewage as Manure.

A scheme to utilize as manure about 130 million gallons a day of Calcutta's sewage the major part of which at present goes to waste, has been suggested to the West Bengal Government by Sir Datar Singh, Vice-Chairman, Indian Council of Agricultural Research.

Calcutta's daily sewage flows continuously into two sedimentation tanks which are believed to be the largest in the East and have the capacity to deal with the entire dry weather flow of sewage. The suspended solid particles are sedimented at the bottom, which are then pumped into two open lagoons where the sludge is dried. The effluent containing about 25 per cent of the total solids of the sewage is drained into the sea. The minimum annual output of dried sludge is 30,000 tons as against a total deposit of 100,000 tons of sludge.

This would involve increasing the number of sedimentation tanks to 12, and extending an existing railway track for quicker and cheaper transport. Expert opinion also favours the utilization of the effluent for irrigating about 20,000 acres of land.

Standard Bolts and Nuts.

An agreement standardising threads on bolts, nuts and screws has, it is learnt, been signed by U.K., U.S.A. and Canada. It appears to have taken 30 years' negotiation for uniform threads which can be used on the machinery of any description made in any of the participating countries. This agreement is hailed as one of the most important steps towards practical co-operation among nations since it enables each country to save vast expenditures every year.

British Experts for U.P.

The U.P. Government is considering to secure the services of two British Engineers for the province on a long-term contract. One of the engineers is to serve as consultant for the Rihand Dam Project and the other is to be chief planner for light industrial development schemes.

Contractors have to queue.

The Contractor to-day is in much the same position as the householder. Like the householder, the contractor has to stand in queues; like the former he feels frustrated at every turn. And it would be just as unreasonable to blame the householder for the shortage of rice as to blame the contractor for the shortage of building materials.

Coming Events.

Indian Science Congress is to hold its 36th Session at Allahabad from January 2 to 8, 1949 under the auspices of the University of Allahabad. Over 20 Indian Scientific Organizations, it is learnt, will be holding their meetings during the Science Congress week.

A group of engineers under the auspices of the Central Board of Irrigation will tour Nagpur, Mysore, Madras and Bombay and visit various engineering works. They will leave Nagpur by a special train on December 26, and disperse in Bombay on January 13. All the provinces and major States, it is learnt, have been invited to participate by sending a number of their engineers engaged on irrigation and hydro-electric works.

SOIL-CEMENT BLOCKS FOR BUILDING

T. P. KUTTIAMMU, B.E., A.M.I.E.,

Executive Engineer, P.W.D., Madras.

Shortage of conventional building materials like bricks, stone, timber and iron and the consequent rise in their prices have in recent times given an impetus to search for cheap and locally provided substitutes. Several investigations in this line were taken up and pursued at the Irrigation Research Station, Poondi, on the suggestions and direction of Rao Bahadur Sri A. R. Venkatachari, Chief Engineer for Irrigation and Buildings, Madras. Studies made on the use of cement—stabilised soil for building work on hundreds of specimens in the laboratory and on typical works in actual construction proved particularly successful. These are briefly described in this note.

Test Materials

Tension, compression and absorption tests were made on specimens made of three types of soils available at Poondi, namely (1) red sandy loam, (2) yellow sandy clay loam and (3) black clay loam and various proportion of cement. The soil sample in each case was sieved through a quarter inch sieve to remove gravel before use. For purpose of comparison specimens made of cement and sand were tested simultaneously. The sand used was obtained from the Kortaliar bed at Poondi and was sieved through a 14 mesh sieve to exclude coarser particles. Mechanical analyses, and other charateristics of these soils and sand are furnished in Table I.

Ground moulded country bricks tested for tension, compression and absorption were obtained from the kilns at Aminjikarai near Madras. Cement used was of the Nilgiri brand received from Madukarai.

Laboratory Tests

Tests relevant to the present study are abstracted in Tables II, III and IV.

In these tests specimens for compression and tension were made following standard procedure. Water added for sand cement specimens was 5 per cent by weight of sand+30 per cent by weight of cement. For soil cement specimens about 12 per cent water was used which was found by experiment to be nearly the optimum for maximum compaction. Sand cement specimens were cured under water and soil cement specimens under wet gunny. Tension tests were made on briquettes of 1" square section and compression tests on 4" cubes. Tests results for 3-day, 7-day and 28-day tests are furnished. Compression tests on bricks were made on whole bricks, while for tension tests briquettes of standard size were carefully cut out of a few bricks. All these tests were made on Adies, Anslers' or Bucktons' testing machines.

For absorption tests small specimens weighing about 50 gms. each were cut out of bricks and soil cement blocks and heated in an electric oven until all moisture was driven out. They were then soaked in water for 24 hours and the percentage of moisture absorbed was found out by weighing again.

Observations and Inference

Referring to these tables the following inferences were drawn. These were generally confirmed by other tests not detailed here.

(*a*) Both in tension and compression the specimens indicated strength varying with the proportion of cement in the mix. For mixes leaner than 1 : 6 the fall in strength was more rapid than for richer mixes.

(*b*) Strength in all specimens increased with the number of days cured. Development of strength was more rapid during the first week than after. Sand cement specimens developed full strength very much earlier than soil cement specimens.

(*c*) In compression and tension soil cement specimens made of red sandy loam or yellow sandy clay loam (A and B in tables) were always stronger than sand cement specimens containing the same proportion of cement. Specimens made of black clay loam were generally stronger than sand cement specimens in compression, but weaker in tension.

(*d*) Values for load at first crack fluctuated considerably for various specimens whereas those for crushing strength remained fairly consistent. The variation between first crack and crushing loads was large for bricks, but small for sand cement or soil cement blocks. This could be taken into consideration for determining the factor of safety for design purposes.

(*e*) For a mix of 1 : 6 red sandy loam block was the strongest in compression. For leaner mixes yellow sandy clay loam and black clay loam showed greater strength.

In a well-graded soil having a sufficient quantity of fines to fill the pores, less cement would be required to give the same strength as a poorly graded sandy soil.

(*f*) Taking a factor of safety of 4 red soil cement blocks of mixes as lean as 1 : 12½ could be designed for 2 to 3 tons/ sq. ft. loading. Sand cement blocks of similar strength will need mixes richer than 1 : 8. Though blocks of soil cement of mixes leaner than 1 : 12½ did show considerable strength, their adoption could not be recommended without further tests.

(*g*) Soil cement blocks of mixes leaner than 1 : 6 were not as strong as bricks. However the strength of brick masonry is governed by the mortar used and it is not necessary to have blocks as strong as bricks.

(*h*) Soil cement blocks made of *red sandy loam* absorbed 13% less moisture than ordinary bricks, yellow sandy clay loam absorbed 47% more and black clay loam absorbed 77% more. Adoption of clay loam on works could not be recommended without further tests on its shrinkage and other properties.

Tests on Works: For examining the building properties of soil cement, blocks were made of various shapes and sizes using the red sandy loam above mentioned and cement in the ratio 12½ : 1. The mix was consolidated by hand ramming in teak wood moulds using about 12% water. After curing them for about two weeks under wet gunnies, they were used for constructing small cisterns, drains, culverts, revetments and huts at the Research Station. They were set in clay, lime mortar or cement mortar. They were plastered over with cement mortar or merely pointed. *Red soil* cement was also tried in various mixes for plastering, pointing and flooring. A circular hut 18' diameter inside and carrying a heavy concrete arched roof was made of specially made red soil blocks 9" thick. A pavilion 15 ft, square had 7" thick dwarf walls of red soil cement and 14" x 14" pilasters. This too had a heavy domed roof. A store room 45' x 15' and a latrine 4' x 3' were built with 8" thick walls. All these have remained exposed to weather and water for months and have without any exception stood well.

From an observation of these works the following conclusions appeared justifiable :—

(*a*) Red soil cement blocks can be made to any shape required for ordinary building work. It weighs about 100 lbs. per cubic ft. and sizes up to 16" x 8" x 6" are easily handled.

(*b*) Depending upon the nature of soil and consolidation, absorption will vary. This will have its influence on the quantity of water to be used for mortar.

(*c*) Quantity of mortar required for work using soil cement blocks of 16" x 8" x 6" size will be about 15 c. ft. for 100 c. ft. of masonry. This is about 50% less than the quantity required for brick masonry.

(*d*) Once blocks are ready, progress on work can be more rapid than with small sized bricks. The blocks are easily cut, dressed or shaped by means of a trowel and chisel.

(*e*) Pointing is easy and cheap. The appearance of red soil cement is very pleasing.

(*f*) Plastering can be done on soil cement blocks. Plastering with red soil cement is also satisfactory.

(*g*) Flooring with red soil cement is generally satisfactory and cheap.

(*h*) Red soil sandy loam of the composition shown by mechanical analysis comes out best and where similar soils are available, extended trials appear justified. Yellow sandy loam has to be tried out more than red soils but may prove suitable. Black clay loam seems unsuitable for this purpose but fuller investigation seems necessary.

Cost Analysis: A statement of costs for 100 c. ft. of red soil cement block work as actually observed at Poondi is given below :—

I. Soil cement block work in cement mortar 1 : 6—100 c. ft.—

	Rs.	A.	P.
125 c. ft. soil sieved through ¼" mesh at site of work @ Rs. 5 per 100 c. ft. ...	6	4	0
8 c. ft. cement @ Rs. 90 per ton for blocks ...	28	13	0
225 blocks—labour for moulding @ Rs 10 per block ...	11	12	0
15 c. ft. sand for mortar @ Rs. 8 per 100 c. ft. ...	1	3	0
2½ c. ft. cement for mortar @ Rs. 90 per ton ...	9	6	0
Labour for masonry work and mixing mortar ...	13	0	0
Proportionate cost of moulds for blocks, oil, etc. ...	3	0	0
Sundries for curing, watering, etc. ...	1	10	0
	75	0	0

II. Country brick masonry in cement mortar 1 : 6—100 c. ft. at Poondi Rs. 100.

Saving in cost on 100 c. ft.—25 %

Conclusion: On the whole it can safely be stated that red (sandy loam) cement blocks of particular compositions give good results and can be given extended trials as substitutes for bricks in situation where the former will be cheaper. Its cheapness will depend upon the availability of red soil at site, availability of cement in sufficient quantities and the non-availability of bricks at cheaper rates. As regards yellow sandy clay loam containing more than 50% sand, and less than 30% clay, the results are encouraging but further experiments are necessary. Black clayey loam gives poor results generally.

TABLE No. I.

Tests on Soil Cement Blocks: Description of Soils used.

No.	Distinguishing Mark.	Description of Soil Type.	MECHANICAL ANALYSIS				Remarks
			Sand	Silt	Clay	D 60* / D 10	
1	A ...	Red—Sandy loam ...	69.5%	20%	9.5%	19	
2	B ...	Yellow—Sandy clay loam ...	53	16	31	120	
3	C ...	Black—Clay loam ...	40	16	44	45	
4	D ...	Sieved river sand ...	100	...	...	1.6	

* Uniformity co-efficient.

TABLE No. II.

Tension Tests on Soil-Cement Briquettes.

No.	Cement-Soil.	Description of soil used.	Stress in lbs/ sq. in.			Remarks
			3 days	7 days	28 days	
1	1 : 6	A. Sandy loam ...	92	160	306	
		B. Sandy clay loam ...	96	104	172	
		C. Clay loam ...	69	75	94	
		D. Sand ...	91	84	63	
2	1 : 8	A. Sandy loam ...	51	78	217	
		B. Sandy clay loam ...	63	78	138	
		C. Clay loam ...	58	62	82	
		D. Sand ...	57	74	75	
3	1 : 10	A. Sandy loam ...	31	66	176	
		B. Sandy clay loam ...	57	65	103	
		C. Clay loam ...	35	46	69	
		D. Sand ...	55	48	51	
4	1 : 12	A. Sandy loam ...	50	50	135	
		B. Sandy clay loam ...	48	57	98	
		C. Clay loam ...	32	43	67	
		D. Sand ...	39	38	49	
5	1 : 15	A. Sandy loam ...	...	...	...	Not tested
		B. Sandy clay loam ...	45	48	74	
		C. Clay loam ...	23	28	33	
		D. Sand ...	...	...	...	Not tested

TABLE No. III.

Compression Tests on Soil-Cement Cubes.

No.	Mix Cement Soil.	Description of soil used.	Stress in tons/sq. ft.						Remarks
			3 days		7 days		28 days		
			First Crack	Ultimate	First Crack	Ultimate	First Crack	Ultimate	
1	1 : 6	A. Sandy loam ...	17·6	22·5	33·8	37·4	66·9	72·9	
		B. Sandy clay loam ...	12·2	22·4	9 9	26·1	34·6	42·4	
		C. Clay loam ...	9·5	17·1	12·7	22·2	29·9	34·4	
		D. Sand ...	10·2	14·7	19·1	21·6	19·1	21·9	
2	1 : 8	A. Sandy loam ...	10·8	13·4	13·5	18·5	18·6	22·8	
		B. Sandy clay loam ...	7·4	17·1	8·0	23·0	26·8	39·6	
		C. Clay loam ...	8·1	15.2	9·9	15·8	29·0	31·7	
		D. Sand ...	13·2	15·2	14·7	15·5	12·8	14·2	
3	1 : 01	A. Sandy loam ...	8·3	9·7	14·7	20·0	18·3	19·8	
		B. Sandy clay loam ...	5·4	14·5	11·7	21·7	32·9	36·7	
		C. Clay loam ...	5·0	10·7	7·0	14·1	18·7	20·0	
		D. Sand ...	8·3	8·3	9·3	10·5	4·5	7·1	
4	1 : 12	A. Sandy loam ...	6·0	7·4	11·3	13·1	11·9	13·8	
		B. Sandy clay loam ...	9·7	12·7	8·6	18·1	23·0	26·2	
		C. Clay loam ...	5·0	6·8	7·2	10·2	17·1	17·8	
		D. Sand ...	6·7	7·1	4·4	4·4	5·8	7·4	
5	1 : 15	A. Sandy loam ...	...	...	...	...	...	...	Not tested.
		B. Sandy clay loam ...	6·3	9 2	5·4	13·9	17·0	20·3	
		C. Clay loam ...	2·4	4·3	1·6	3·5	8·6	9·5	
		D. Sand ...	...	...	...	...	...	...	Not tested.

TABLE No. IV.

Tension and Compression Tests on Country Bricks.

No.	Description	Tension Lbs./sq. in.	Compression		Remarks
			First Crack tons/sq. ft.	Ultimate tons/sq. ft.	
1	Ground moulded country bricks ...	91	5.3	71·6	

TABLE No. V.

Absorption Tests on Bricks and Soil-Cement Blocks.

No.	Description	Absorption in percentage Weight.	Remarks
1	Red Sandy loam: Cement ...	12.54%	
2	Yellow Sandy Clay loam: Cement ...	21.25	
3	Black Clay loam: Cement ...	25.55	
4	Country Bricks ...	14.44	

HEALTH AND SAFETY GOVERN BUILDING REGULATIONS

S. P. KERNAHAN

(Of the U.K. Ministry of Works)

In Britain the control of building operations from the point of view of public health and safety is in the main delegated to a local authority, that is, the City Corporation, Borough, County Borough or Urban or Rural Authority, within whose area the building is to be erected.

Attention is principally directed to ensuring that the finished building, with whatever materials it may be constructed, shall conform to certain standards of durability, safety and hygiene rather than to prescribing detailed requirements for the materials of which it may be built. The legal sanction for these requirements is obtained by their inclusion in the bye-laws.

To ensure a reasonable degree of uniformity throughout Britain a series of model bye-laws has been prepared by the Ministry of Health, which is the department principally concerned with the legal regulation of building, and it is the custom for local authorities to employ either in whole or in part this model code as the basis for their own bye-laws.

The prime requirements of the bye-laws are that buildings shall be reasonably fireproof, reasonably weatherproof, and composed of materials not subject to rapid deterioration; that they shall provide certain minimum standards of lighting and ventilation, and that they shall have reasonable drainage and sanitation having regard to the geographical location of the building.

Legal Binding.

For example, the bye-laws may prohibit the construction in areas subject to flooding of buildings intended for human habitation; they may restrict the total height of a building on the grounds of safety from fire, and they may prescribe minimum heights of ceilings, minimum window openings and wall thicknesses, and the methods of construction of flues.

The effect of the bye-laws, it will be seen, is legal rather than technical. In the main, they do not prescribe detailed requirements for the materials of which a building is composed, nor in Britain is there any statutory body to whom such materials must be subjected for test before they are employed for building purposes.

In general the requirements of the bye-laws are simply that the materials shall be suited for the purposes for which they are to be used. The two paragraphs providing the general authority for the rejection of unsuitable materials, for instance, read thus: "All other materials used in the construction of a building shall be of a suitable nature and quality for the purpose for which they are used and, when necessary, shall be adequately mixed or prepared," and "All materials used in the construction of the building shall be applied, used or fixed, so as adequately to perform the functions for which they are used."

Apart from these statutory provisions, which provide the legal means for ensuring that buildings shall not be actually dangerous to the community, *there are a number of organisations concerned with the testing, examination and improvement of building materials*, and with putting the results of the latest knowledge before the building industry.

Testing Stations.

As far as testing stations proper are concerned, the two most important are the National Physical Laboratory and the Building Research Station both State organisations administered by the Department of Scientific and Industrial Research. The distinction between them is that the National Physical Laboratory is, in the main, concerned with physical measurement in the laboratory, that is to say it undertakes the measurement of heat transfer through materials; study of sound transmission, or the accuracy of measuring or recording devices including electricity and gas meters.

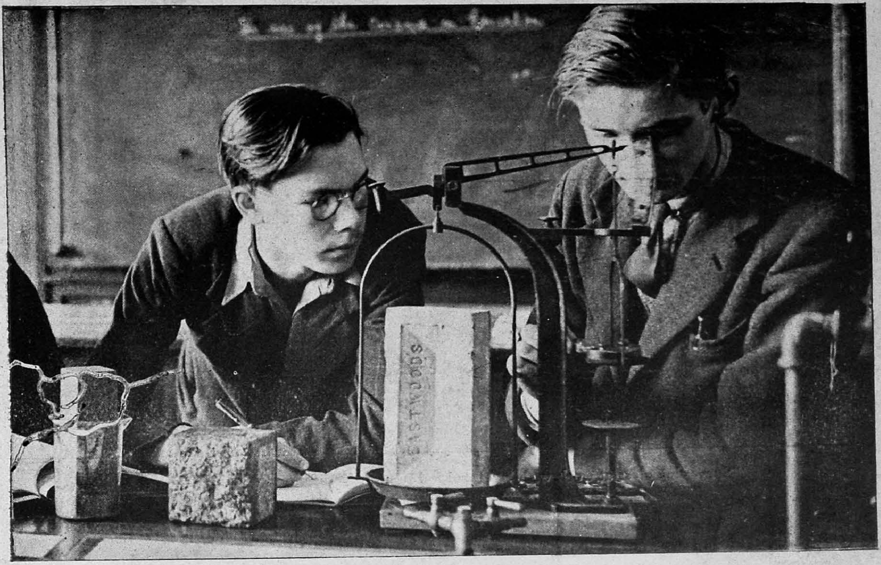
The Building Research Station, on the other hand, is concerned more with the performance of a product under the conditions it may encounter in use—it will report, for example, on the fire resistance of a building material, the performance in use of a waterproofing agent, or the moisture absorption of a brick. Neither body, however, has any statutory powers; each is simply an official testing station to which any person who wishes may apply for an independent, authoritative report on a building material or component.

The third body involved is of a rather different character. The Ministry of Works is not only the Government's own building agent and technical adviser, but it undertakes certain broader functions in the general organisation of building research, the study of materials and methods and, in conjunction with other advisory bodies, the formulation of codes and standard specifications for good building.

(Continued on page 18)

Learning to Build

SCHOOL OF BUILDING, BRIXTON,

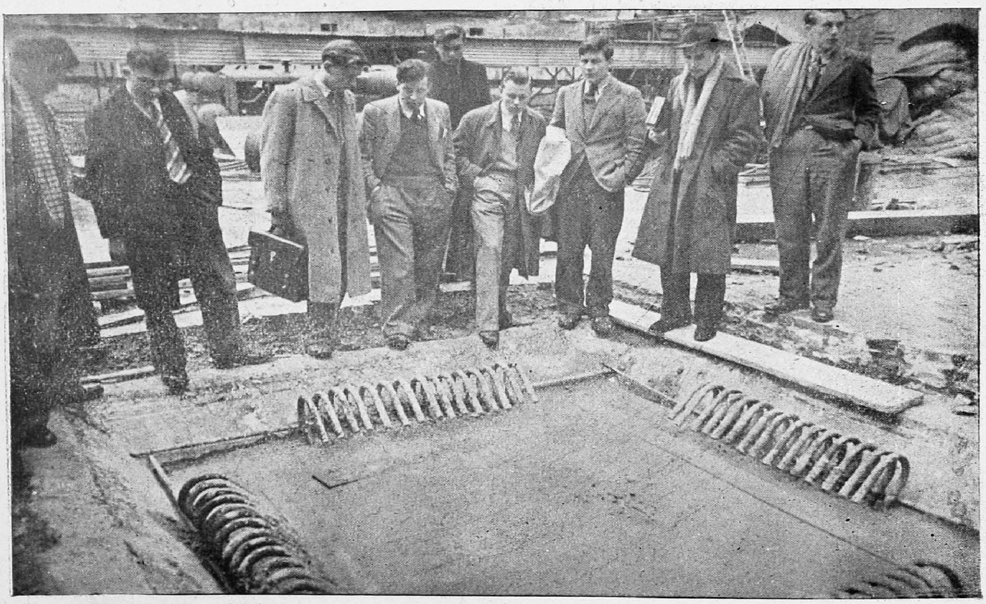


Chemistry and Physics are part of the technique of modern building. These boys are testing the absorption capacity of bricks.

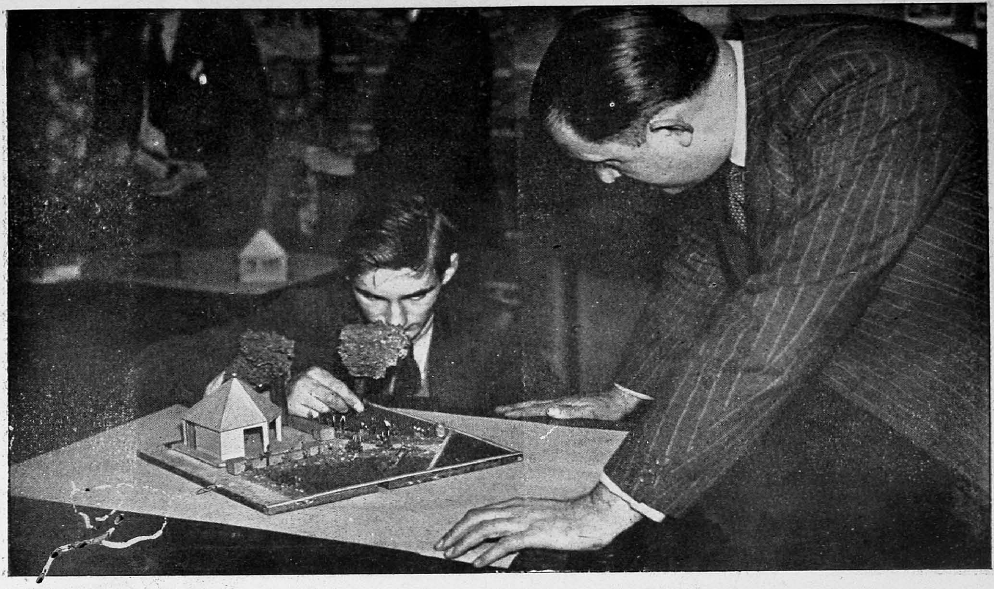
Putting one brick on top of another is a highly skilled job. The apprentice hand gains skill in the class room.

Photos by courtesy: B.I.S.

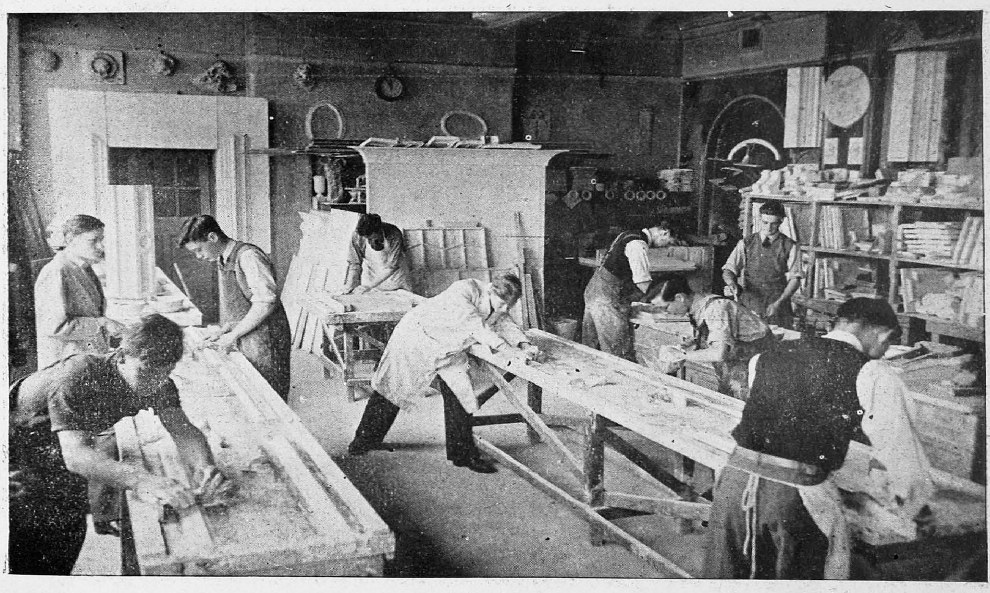
Surveying class at work with level and rod in a public park near the school.



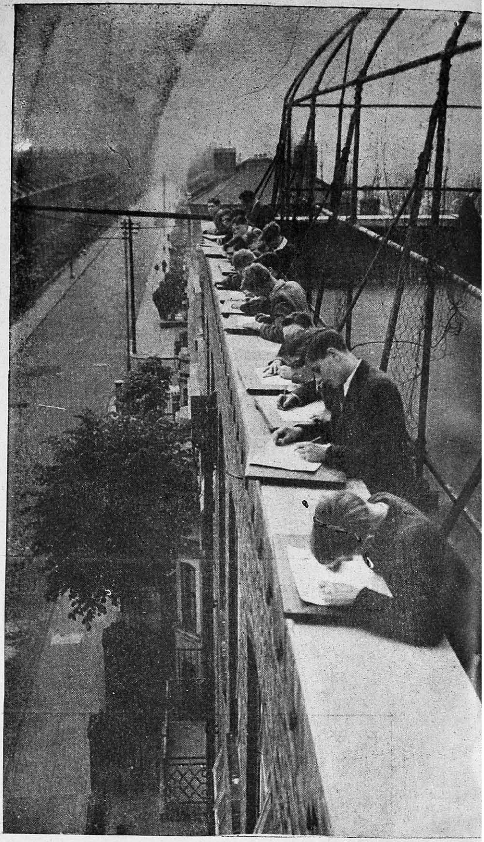
Conducted tour of an important building operation. These boys are inspecting a pier foundation.

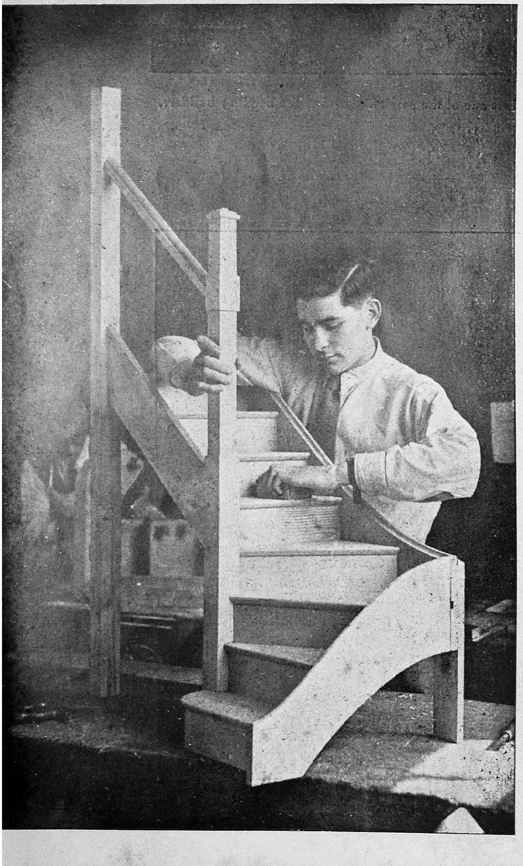


Small beginnings: A scale model accurate in every detail, is one of the earliest efforts of the budding builders.



Scope for the artist: Students make mouldings in the plaster shop.





Students sketch an existing civic pattern from the school roof. *Left*:—Finishing touches to a scale model of a staircase in the carpenter's shop.

METHODS OF TERMITES' ATTACK

HENRY A. PORTER, F.R.I.B.A.

The most common method of attack is by means of the earth tunnel they construct across concrete paving or up walls of buildings. On considering wooden ground floors, it should be remembered that most of the economic species will build small mounds to enable them to reach the joists from the ground, and therefore the space between the floor and the ground should always be accessible and large enough for a labourer to crawl about in. A very popular point of entry is *via* wood posts fixed in the ground by trellis fixed for climbing plants, rain water and service pipes or electric cables. Another common point of access is up the inside of brick walls, or the cavities of concrete block walls.

A termite will riddle a brick wall set in lime mortar. One in cement mortar is not termite proof. I am prepared to believe a termite will find its way between the cement rendering and the wall itself. Hollow concrete block walls are extensively used in some countries, and these form ideal access for the termite to attack the upper floors and roof timbers, as well as providing storage space for the ground excavated for extension of the next. It is stated that cement concrete cannot be penetrated by termites, but the writer knows this not to be the case. All concrete is subjected to minute cracks and contains small interstices, and the insect can travel from one to another using its powerful jaws, some species exuding a secretion which apparently softens the concrete. Staircase newels and door frames set in cement concrete laid on the ground simply "ask for it."

It will be noted that the previously mentioned points of attack start from the ground, but the non-subterranean termite presents an entirely different and much more difficult problem. Its alates, on emerging from the parent nest, fly to a conveniently placed piece of wood, which may be a door post, roof timber or table or chair, and there start the new colony. There is no necessity for them to have connection with the earth. They seem to prefer the higher parts of the building, and the favourite point of entry is in the roof, by crawling under the slates or tiles and finding a home in the battens or rafters, from which, as the colony increases or fresh flights take place, they gradually infest all the timber in the building, including furniture.

Having reached the selected piece of wood (for the termite, although liking most woods, has its preferences) it proceeds to damage it by boring tunnels through the wood in the direction of the grain. Except in very rare cases, it does not work "on the surface," but once in the wood remains there, and gives no indication on the surface that it is "in residence." A piece of wood can be riddled to a condition of collapse without the uninitiated suspecting its presence. Wood which has been painted will be eaten completely to the skin of paint, or wood treated by preservatives consumed to within $\frac{1}{8}$ in. to $\frac{1}{4}$ in. of the surface. The majority of the subterranean termites partly digest the wood, carrying it down to the nest where it is stored and forms the "fungus garden," but the non-subterranean termite, having no large nest in which to store, will fill up the galleries with its excrement until such time as the storage space is filled, when it will open a small hole, push out the excrement and close the hole after the operation. Hence the small piles of wood pellets so familiar to those living in termite-infested lands. It is on record that termites have penetrated the lead covering of electric cables to get to the paper part of the insulation, and much damage and some inconvenience have been caused. Another frequently adopted method of spreading its activities over the building is to use the wood electric light casing as a runway, either by forming galleries under the cover or between the casing and wall.

In dealing with termites, it is of the utmost importance to remember that an attacked piece of wood shows no surface evidence that it is being destroyed, and many months or years may pass before any but those most expert will suspect the presence of termites. The wood may be damaged to a point of collapse, and probably will have collapsed before one realises it is being attacked. It is as useless to rely on surface inspection as on surface treatment. Many incidents are reported of whole roofs and/or floors, considered free from termites, being found to be riddled to danger point and having to be renewed at great expense.

The insidious methods adopted by termites in obtaining access to timbers, having been briefly explained, one must realise the difficulty of devising means of keeping them out of buildings. Indeed, no practical method can be evolved to keep out the non-subterranean termite.

We will consider the subterranean termite first, bearing in mind the fact that this species must have uninterrupted connection with the ground. The construction of a

barrier impassable through, or over, by the termites must be placed at certain parts of the building. The material out of which this should be constructed is of great importance. Certain authoritias recommend a strong mixture of cement. The writer does not agree with this, having found too many instances of termites penetrating through this material. Even a two to one mixture of cement and sand 4½ in. thick is not effective, as small settlement cracks must appear (even if reinforced) and the termites will find the weak spot. Lead, laid similar to a damp course, is also recommended but cannot be relied upon, as instances are on record where termites have penetrated this. Bituminous compounds are not to be relied upon and zinc will rust. *The only material which can be used safely is copper, but it is important that this be fixed in the most effective spots, determined by the nature of the building.*

The only way to prevent damage by the non-subterranean termites (which cannot be kept out of buildings) is to render the wood unpalatable to them.

This type will not attack clothing, boots, carpets and similar materials, unless they are in contact with untreated woods. There are at least three methods of treating the timbers, namely, brush coating, steeping and impregnating under pressure! The writer would recommend only the latter, as the other methods have been found ineffective. Those who recommend them do not realise the fact that the majority of termites do not work on the surface of the wood. Even if timbers are coated on every part of their surfaces (which in practice is rarely done) the termite will obtain an entry through a developed shake, an untreated joint, a withdrawn nail-hole, a hole made by bugs in the growing timber and even a bruised spot caused by a hammer mark or damage whilst fixing. The steeping or boiling treatment does not give sufficient penetration, or if used on soft open-grained work will consume an uneconomical amount of preservative. It is agreed by all that the "under pressure vacuum" treatment is the most effective, and the writer claims further that it is the only effective treatment. Again, the woods used must be selected and capable of thorough impregnation. There are hard woods that cannot be thoroughly impregnated economically, but will be readily eaten by termites if other woods are not available.

The study of termite control presents an interesting problem. Beyond what I have written, there are no set rules to be observed. The methods to be employed differ widely in accordance with the construction of, and materials used in, the building, its site, and the species of termite present.

The treatment of existing buildings suffering from termite attack also presents a varied and important problem, and there is not space to define the methods successfully adopted. Here again it depends on the nature of the building and locality, but stress should be laid upon the important point of ridding a building of its attackers before new timber is fixed in place of that destroyed.

The obvious necessity of this should be apparent to anyone, but, absurd as it may seem, buildings are often treated without this step being taken. This is due to two things, first, the oft-stated belief that the damage is caused by rot and not by termites, and secondly, an unfortunate trust in the "brush coated" methods of timber preservation.

(Continued from 3rd column)

The Codes of Practice Committee is concerned on the other hand with methods of construction of buildings and of installation of components, and it is the eventual intention of the Committee to compile a comprehensive code, stating what is currently considered to be good building practice for every aspect of construction, from site exploration and soil examination and construction of foundations, to the completion of the building itself and the installation of its internal equipment, sanitary, water and heating services and so on.

HEALTH AND SAFETY GOVERN BUILDING REGULATIONS

(Continued from page 12)

Connecting Link.

Thus a broad division can be drawn between those organisations in Britain which are concerned with building research and testing, and those whose functions are to see that the knowledge so gained is put to practical use. The Ministry of Works is the connecting link between the two categories and is, in fact, the only body with activities in both spheres. It maintains its own scientific division and has a field test unit where new materials or building methods are developed.

In so far as State-financed building is concerned, the Ministry advises the Government on the suitability of competing systems and products. It may also advise what alterations should be made in the model bye-laws to keep pace with current developments in materials and techniques.

In its other function—the formulation of codes and standard specifications—the Ministry of Works acts with two other bodies, the Codes of Practice Committee and the British Standards Institution. *Neither of these two organisations is in any sense a Government body; their membership is composed principally of representatives of industry and of the scientific and professional societies. They are, however, officially recognised and work in close co-operation with the Ministry of Works and the Ministry of Health in matters relating to building.*

Standards and Practices.

There is a certain distinction between the matters dealt with by the British Standards Institution and those dealt with by the Codes of Practice Committee. The Institution, for example, is the body responsible for the preparation of standard specifications for materials and components, such as steel structural members, clay roofing tiles, locks and latches for doors, metal windows and cupboards, and for the dimensional standardisation of such articles.

(Continued to 2nd column)

LAW REPORT

COURT OF APPEAL

Madras High Court.

Before Mr. P. V. Rajamannar, Chief Justice and Mr. Justice Rajagopalan.

T. Radhakrishna Chettiar *v.* The Government of Madras

Land Acquisition Act (I of 1894), Section 23—Acquisition of house and ground situated in a Municipality—Compensation—Market value—Computation—Criterion for Arriving at number of years' purchase.

The proper method of valuation to be adopted in a case of compulsory acquisition relating to a house and ground situated in a Municipality and fetching regular income is to assess the value on the basis of capitalisation of the net annual income. The number of years purchase to be adopted for capitalisation is to be arrived at by taking into account the interest yielded by Government securities at the time of the notification under section 4 (1) of the Land Acquisition Act.

Where the gilt-edged securities were carrying interest at 3 per cent at the time of the notification under section 4 (1) of the Land Acquisition Act, the annual rental value must be capitalised at 33-1/3 years' purchase.

The Officiating Chief Justice in his judgment observed:—This appeal arises out of a reference made to the Subordinate Judge of Kumbakonam under section 18 of the Land Acquisition Act in respect of the valuation of the property belonging to the appellant which was acquired under the Act. The date of the notification under section 4 (1) of the Act was 24th November 1942. The property acquired is a site measuring 7,156 square feet with a building thereon and wells and trees, situated in Town Survey No. 2202 of the second ward of the Kumbakonam Municipality. The Land Acquisition Officer valued the site separately at Rs. 2,236-4-0 calculating at the rate of As. 5 per square foot. He valued the house, compound wall, latrine and 2 wells at Rs. 1,041 and the trees at Rs. 132–8–0. On the aggregate of Rs. 3,409–12–0 he allowed a statutory allowance of 15 per cent and awarded a total compensation of Rs. 3,921–3–5. The learned Subordinate Judge confirmed the award in toto.

In appeal it is conceded on behalf of the appellant that the proper method of valuation to be adopted in a case like the present relating to house and ground situated in a Municipality and fetching regular income is to assess the value on the basis of capitalisation of the net annual income. The learned Government Pleader did not seriously contest that this was the proper method.

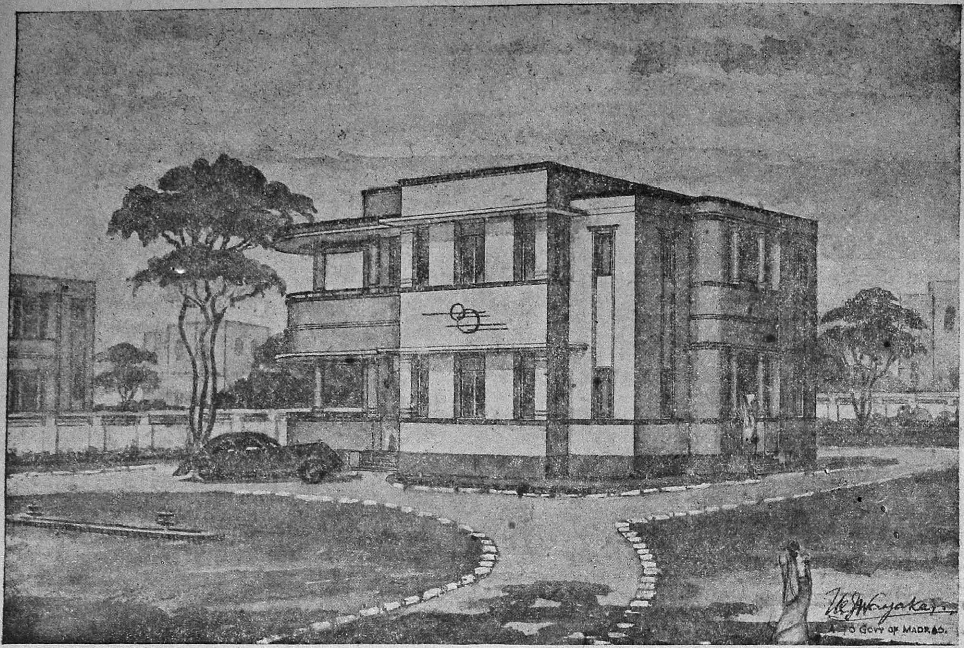
It was a common ground in the lower Court that the gross annual rental value of the property may be taken to be Rs. 233–12–0 and the net annual rental may be fixed at Rs. 154–12–4. The only question remaining for determination was as to the number of years purchase to be adopted for capitalisation. Several decisions were cited on this point by both the learned Counsel for the appellant and the learned Government Pleader. As all these decisions do not go the same way it is necessary to examine each decision to find out the principle if any which was enunciated in each of these cases.

Taking first the earliest case, of the two learned Judges who decided the case Newsam, J., approached the question from the following stand-point. It was first necessary to ascertain the gross income from the acquired land. The next step should be to ascertain the net income. Having ascertained the net annual income it must be capitalised by computing the number of years' purchase. This must depend upon the rate of interest prevailing on gilt-edged securities at the time of the acquisition, i.e., on the date of the notification under section 4 of the Act. To the figure thus arrived must of course be added 15 per cent for compulsory acquisition. Applying these principles, having regard to the rate of interest on gilt-edged securities at the time of the notification which was 3½ per cent, the learned Judge arrived at 30 years' purchase. The other learned Judge, Venkatasubba Rao J., agreed with Newsam, J. He observed as follows: "The return from landed property, generally speaking, reflects the prevalent rate of interest on money investments. . , The Government of India loan at that time took the form of a 3½ per cent issue liable to income-tax . . . When there is definite evidence that the annual return on investments is 3½ per cent it would be wrong to adopt the arbitrary rule of the 20 years' purchase. The return having been ascertained, the years purchase is arrived at by dividing 100 by the figure of such return. In the present cases the return is about 3½ per cent and the number of years' purchase which it would be right to allow would therefore be about 30.

It is true that the learned Judge earlier in his judgment observed that the rule of the number of years' purchase is not a theoretical or legal rule but depends upon economic factors. The most important of such economic factors is, as pointed out by him in illustration, the prevailing rate of interest.

In the present case it appears from the judgment of the lower Court that it was not disputed that gilt edged securities were carrying interest at 3 per cent at the time of the acquisition. The annual rental value must therefore be capitalised at 33-1/3 years' purchase. To the value thus arrived, the statutory allowance of 15 per cent must be added. The appeal is allowed as indicated above with proportionate cost both here and in the Courts below.

A. Seshachariar and K. Raghavan appeared for the Appellant and the Government Pleader (K. Kuttikrishna Menon) for the Respondent.



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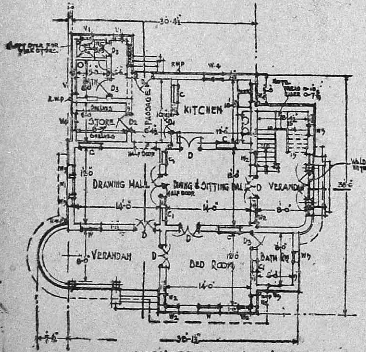

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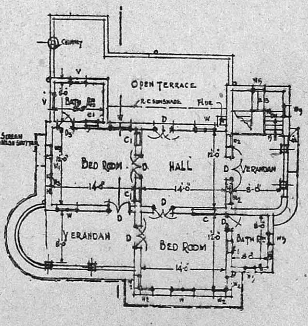

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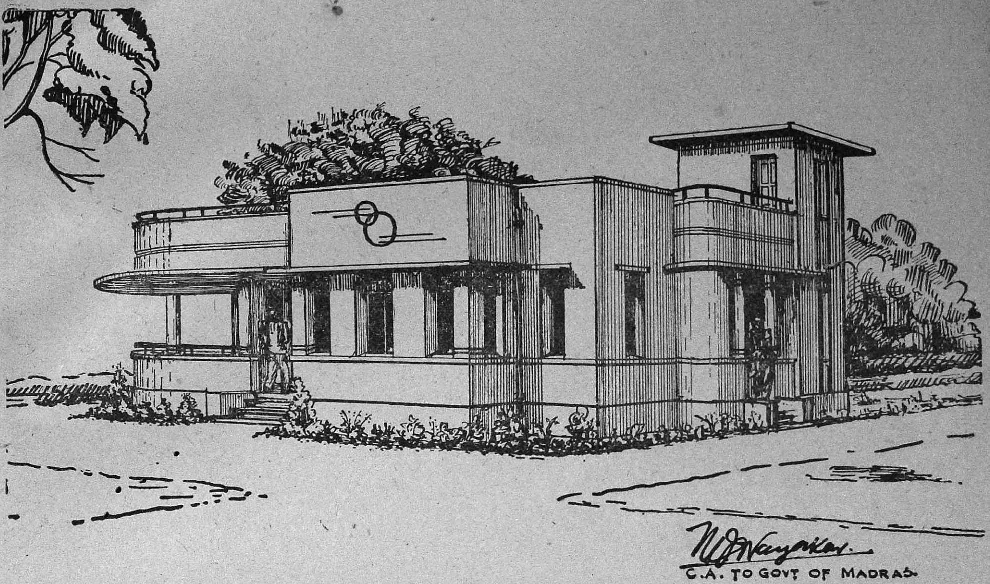

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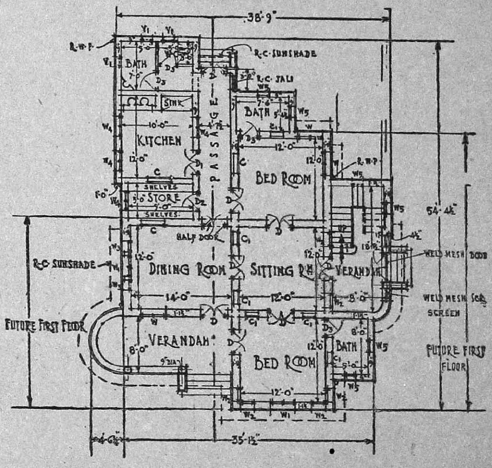

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The Building Gazette

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INQUIRY BUREAU

R. C. Flat in Ceylon.

Query.—I propose to put up a building in Colombo, but certain aspects of the case and local conditions have left me undecided as to the type of roof to be adopted.

Personally I would prefer a Reinforced Cement Concrete flat roof for the entire building to a pitched roof, but the majority of buildings constructed here with R.C.C. flat roofs have not stood up to expectations where waterproofing is concerned. There has been a tendency for these flat roofs to develop cracks and consequent leaks.

Secondly it has been found necessary for buildings in Colombo to be provided with an insulated ceiling to avoid excessive heat during warm days. This is done by providing a ceiling of planks, asbestos or any other suitable material.

As such it would be very helpful to me if you could advise me as to the correct specification and methods to be adopted for a cement concrete roof to be provided that would be fully satisfactory.

C. RAJATHURAI

P.W.D., Kegalle, Ceylon.

Reply.—Lay R.C. Roof Slabs under proper supervision of R.C. Specialist.

Provide baby brick jelly in shell-lime concrete for slopes 1 in 48 from centre to the edges thoroughly beaten to uniform even surface with knife edges.

Provide air-ducts over slope concrete between masonry walls about 4½" wide × 3" deep, about 1-3" apart. Ducts can be all round at edges by the sides of parapets also.

Construct terrace brick on edge floor over ducts just like Madras terrace over Teak rafters.

Cover terrace bricks on edge floor with 1/2" brick jelly in shell lime to slopes 1 in 48 well beaten with knife edges.

Cover the slope concrete (last laid) with one course of country flat tiles 6" × 2" × 3/4" in cement mortar and crude oil and with another course of pressed clay tiles in cement mortar and crude oil pointed at top with crude oil cement mortar.

Drain off rainwater from top of pressed tiles as well as from ducts (if any leakage) by rain water pipes connected to ends of valleys in slopes.

N. T. PATEL, B.E., A.M.I.C.E.

R.C. Specialist, Madras.

LETTER TO THE EDITOR

Building Cost

Madras v. London

DEAR SIR,—I find the Building Gazette very interesting and the Current Prices for Measured Work interesting when compared with ours here.

I give you some examples:

	Madras			London		
	Rs.	A.	P.	Rs.	A.	P.
Half-brick wall in lime mortar *	48	0	0	73	5	0
Rendering ½" to wallls in cement and sand	13	0	0	13	5	0
Water bound distempeing 2 costs	9	0	0	10	5	0
Painting two coats of oil colour	25	0	0	30	12	0

All the above are for 100 sq. ft. and I have based the exchange at Rs. 13–4–0 to £ 1–0–0 which I think is about right.

Yours faithfully,
A. E. BUTTERS

Wyboston, Beds, England.

* Madras rate is for country bricks and London rate is for Wirecut bricks.—*Ed.*

PERSONAL

Mr. W. X. Mascarenhas.

Mr. W. X. Mascarenhas, former Principal of the Poona Engineering College, is to be in charge of the building programme of the Indian National War Academy at Poona.

Rao Sahib K. K. Nambiar.

Rao Sahib K. K. Nambiar, the new Chairman of the City Improvement Trust, Madras, has just completed a study-tour of Calcutta, Kanpur and New Delhi.

Rao Sahib V. P. Bedekar.

Rao Sahib V. P. Bedekar, Special Engineer, Miraj Water Works and former State Engineer, Miraj Senior, has been transferred by the Bombay Government as Executive Engineer at Palanpur for the new P.W.D. Division created for the merged Gujerat States.

Mr. N. D. Gulhati, I.S.E.

Mr. N. D. Gulhati, I.S.E., has been appointed temporarily to act as Deputy Secretary to the Ministry of Works, Mines and Power, New Delhi.

Mr. R. Hirachand.

Mr. Ratanchand Hirachand has been re-elected Chairman of the Bombay branch of the Engineering Association of India.

OBITUARY

Col. A. P. Nanda, R.I.E.

The death is recorded of Col. A. P. Nanda, R.I.E., at the age of 36 after a brief illness in Poona.

Col. Nanda had a brilliant military career and served the Indian Army for 17 years.

Col. Nanda was educated at the Government College, Lahore, and took his tripos in engineering at Cambridge University. He took his military training at Woolwich Academy and was commissioned in the Indian Army in 1933.

AEROPLANE HANGAR DESIGN

GERMAN PRACTICE

The following is an extract of a paper read at the Institution of Civil Engineers by Doctor—Ing. Alfred Memel, a former Member of the German Air Ministry.

The Optimum Hangar.

Within the upper limit of 37,600—43,000 sq. ft. of parking the most advantageous form of hangar is that having a rectangular plan without intermediate supports. The maximum clear span which is found suitable is about 279 ft. In special circumstances, as, for instance, where site room is limited, it may sometimes be expedient to construct two hangars side by side, or one behind the other, separated by a fire-resisting wall. Moreover, avoidance of intermediate support is an advantage not only from the point of view of increased space efficiency but also from that of defence against aerial attack.

As regards the relationship between length and depth of the covered rectangle, the essential consideration is the fact that for operating reasons the doorway is always placed in the long side of the rectangle, and the more the rectangle approximates to a square the more favourable is the solution from a constructional point of view. The ratios of depth to span usually found satisfactory in Germany vary round 6 : 10, 7 : 10 and 8 : 10, the lower values being applicable to parking hangars and the higher values to those which are used for repair work on the aircraft.

General Construction.

The arrangement and construction of the girders is governed by operating conditions. It is an advantage from several points of view that the hangar should be low, mainly in order to offer as small an obstacle as possible to aircraft when taking off and landing, but this requirement, which entails longer spans and, therefore, a greater constructional depth, as in conflict with the need to keep the floor space free from supporting columns. Since the door opening is always placed in the long side of the rectangular plan, the cheapest solution as a rule is that which makes use of a main supporting girder, either over or parallel to the door, with subsidiary girders at right angles resting on it. The placing of the main girder behind the door opening has the effect of decreasing the span of the cross girders, and since the ends of the latter form cantilevers the bending moment in them is reduced. The total weight of steel in a hangar of this type, which has a hollow-tile roof, and extends over two adjoining bays of 164 × 98 ft. each, is about 16.4 lb. per sq. ft.

Other things being equal, the constructional depth, which it is desirable to keep as low as possible, depends on the spans and the loading, and with this arrangement the load carried by the main supporting girder amounts to half the total load if it is in the plane of the doors or more than half if it is placed behind the doors. In the same way, the loading of the subsidiary girders, and therefore the depth occupied by them, can be reduced by increasing their numbers. The following are a few details of various types of construction.

Lattice Girder Construction.

The girders are of 240 ft. span, and the top flange is made parabolic over the whole length. The load is uniformly distributed over the whole of the span except at the ends, with the result that the stresses in the flanges are uniform throughout and there is no load in the web members. As a result fabrication is simplified, the upper and lower flanges being of the same cross section, and consisting of broad-flange beams 21 ins. or 24 ins. in depth. The external appearance of the hangar is characterised by the great saving in constructional depth as a result of the parallel arrangement of the main girders. There is the further advantage in the case of workshop hangars that the whole of the floor space is accessible to lifting gear which can take the form of a number of parallel crane tracks situated between the main girders so as to take up no additional constructional depth and so as to allow of work being carried on in three places simultaneously. Internally, a ceiling of plaster slabs in timber framing is suspended below the cross girders. The object of this provision is to isolate the upper portion of the roof space, while at the same time the roof girders are protected from fire. With the latter object also the columns are encased in concrete. The result is, undoubtedly, very satisfactory.

The requirement that the height of a hangar should be reduced to a minimum has led to the adoption of the rigid frame system of construction with plated webs, for if the constructional depth is small the additional cost of this by comparison with lattice girders is reduced; indeed, where the span is of the order of 246 ft. and the constructional depth 13 ft., and account is taken of the saving in roof construction due to the smaller depth,

there is no appreciable difference in cost between the solid web and lattice girders. However, a solid web girder is safer against fire risks.

The sub-division of the structural system into parallel main girders, adopted for operating reasons, is also satisfactory from the point of view of protection against hostile attack, and the same applies to the use of rigid frame construction for these girders, which confers considerable lateral stiffness on the whole. Moreover, if the purlins are rigidly fixed across the frames, a grid construction is obtained which, while highly indeterminate from the statical point of view, adds considerably to the strength in resisting external damage.

Rigid Frame Construction.

Another type of hangar shows the roof formed with welded rigid frame girders of 164 ft. span, in which the horizontal thrust is taken up by a tie, and which is pre-stressed in order to relieve the structure of any additional stresses which might otherwise result from elongation. Since, however, the roof load constitutes an important part of the total this could not be done until the roof had been erected, that is to say, after the steelwork contractors had left the site. In order to surmount this difficulty the tie is not actually pre-stressed but shortened by a length corresponding to the future elastic elongation under dead load plus one-third of the snow-load.

Frames with Plated Roofs.

Yet another type employs a riveted hangar frame having a span of 244 ft. Two subsidiary bracing frames are placed across the main frames at suitable intervals to support the compression flanges of the main frames in the region of negative bending moment. The roof construction of the hangar consists of light troughing formed from universal plates 3/16 in. thick pressed into corrugations about $7\frac{3}{4}$ ins. deep and welded in the workshop, the panels so formed, about 30 ft. long by 4 ft. 3 ins. wide, being bolted and then welded on the site.

Some form of thermal insulation is absolutely necessary in view of the high conductivity of the steel, since there must be no risk of condensation dropping on to the motors of the aircraft, and this insulation is provided above the roof by a slab of highly insulated material with two layers of roofing felt. To avoid damage the steel troughing is provided with a timber grid which is flush with the top of the corrugations. These corrugated roof plates span the frames without purlins and have a considerable reserve of strength. The constructional details at the corners of the frames are also of some interest, a manhole being provided to give access into the adjoining portions. The total weight of steel in the hangar is about 28.6 lb. per sq. ft.

Evolution of Steel Roof Construction.

The use of steel plate as a roofing material has been found advantageous both from a constructional and economic point of view. With large spans the saving in weight of the girders discounts the additional cost of the steel plate roofing in comparison with heavier roof constructions, even when the necessary thermal insulation is taken into account. As a comparative example, a solid roof made of hollow tiles, or pumice concrete, with 3/4 in. of screeding and protective cover, weighs about 225 lb. per sq. ft. Moreover, the use of steel plates for the roof affords increased stiffness and safety against unforeseen stresses. In addition, the dangers of splinter action are, to a great extent, avoided.

With this system the strength of the roofing plates between the girders is not fully utilised, and attempts have therefore been made to incorporate the roof as an integral part of the structural system. Use is made of pressed steel plates such as are met with in the construction of large tanks. These plates, in strips of 2 ft. wide, are riveted together parallel to the girders, and are attached to the flanges of the girder. The girders themselves are erected as beams on two supports, with a movable lower bearing, so that, under dead load, there is no horizontal thrust and, in particular, the front plate girder situated in the plane of the door-way receives no stress along its minor axis except from wind loads. When the roof has been completely riveted the lower movable bearing is fixed. In addition, loads from snow and wind will thus be taken by the members acting not as girders, but as arches, the thrust from which is transmitted to the two side walls by means of the roof deck between two successive frames. The hangar as a whole is remarkably rigid as a result of the low slenderness ratio (depth to span) of only 1 : 2 in the girders, formed by the roof plates. The roof may, indeed, be regarded functionally as a shell or stressed-skin construction.

Hangar Doors.

On the subject of doors, lifting doors offer many operating advantages, but their cost is excessive, and they are seldom used.

The most usual type of door is the vertical type running on rails at the foot, which transfer the whole of the dead load directly on to the ground without imposing any stresses on the hangar except the horizontal forces due to wind. The door is guided at the top by an arrangement which allows it to move both horizontally and vertically. The provision for vertical movement is necessary in order that the door may not be affected by any changes in the shape of the hangar structure due to snow or wind loads, or to temperature changes. The arrangement may comprise either one or several running rails. In the latter case, the door is divided into several independent panels, each of which is carried on a separate rail, on which it may be moved in a plane parallel to that of the other.

CONTRACTS OPEN

BHUBANESWAR: Capital Construction.

The work of Bhubaneswar Capital Construction in Puri District, Orissa, 20 miles form Cuttack and 35 miles from Puri is being started. Estimated cost Rs. 6½ crores. Work to be completed by the end of 1950. Contractors desirous of doing the work are invited to contact the Chief Engineer, P.W.D., Cuttack.

MADURA: Drainage.

December 17.—Extension to Municipal Sewage farm at Avaniapuram, viz., laying 22" pumping main, constructing a cistern, main and sub-carriers, field bunds, sub-soil pipes, etc. Estimated total cost Rs. 2 lakhs. The Municipal Engineer, Madura.

NAGPUR: Medical College.

December 17.—Construction of Outpatients Department attached to the Medical College at Nagpur. Probable value of contract Rs. 6,76,300. The Executive Engineer, Construction Division, P.W.D., Nagpur.

TRICHUR: Peechi Project.

December 17.—Constructing masonry aqueducts at 6/2 and at 7/6 of Right Bank main canal under Peechi Reservoir Project. The Irrigation Engineer, Trichur.

ANNAMALAINAGAR: University Quarters.

December 20.—Construction of Quarters for Lecturers, Clerks and Workers. Estimated cost Rs. 2,22,000. The Registrar, Annamalai University, Annamalainagar.

JADAVPORE: Laboratory Block.

December 20.—Construction of three storeyed Research Laboratory having a covered area of 37,000 sq. ft., and workshop cum store partly one and partly two storeyed having a covered area of about 11,000 sq. ft. The Registrar, Indian Association for the Cultivation of Science, 210, Bowbazar Street, Calcutta-12.

KUPPAM: Quarters.

December 20.—Construction of 9 blocks of Type Quarters at Kuppam Sub-station. The Superintending Engineer, Mettur Electricity System, Mettur Dam.

NEW DELHI: Sanitary Works.

December 20.—Sanitary Installations to the National Physical Laboratory Building, New Delhi. Approximate cost Rs. 80,000. The Secretary, Council of Scientific and Industrial Research, New Delhi.

BOMBAY: Electric Wiring.

December 21.—Electric Re-wiring of electrical installations in Staff quarters at Jubbulpore, Bhopal, Igatpuri and Jhansi stations of the G.I.P. Railway. The Chief Mechanical Engineer, G.I.P. Ry., Loco Offices, Parel, Bombay.

MADURA: Water Supply.

December 21.—Construction of infiltration gallery, and allied works at Kochadai. Estimated cost Rs. 2½ lakhs. The Municipal Engineer, Madura.

KANPUR: Farm Buildings.

December 24.—Construction of residential and service buildings at Niblett and Nilgaon Mechanised Farms, District Barabanki and Sitapur respectively, costing about Rs. 2 lakhs. The Agricultural Engineer (Irrigation), Central Zone, Kanpur.

UTRAN: Earthwork.

December 24.—Earthwork for assisted siding at Utran for the Electric Grid Department. Approximate cost Rs. 1,50,000. The Chief Engineer, B.B. & C.I. Railway, Churchgate, Bombay.

JUBBULPORE: College Block.

December 28.—Construction of Administration Block of the Government Engineering College at Jubbulpore. Estimated amount Rs. 6·4 lakhs. The Superintending Engineer, P.W.D., Jubbulpore.

SIMLA: Nangal Project.

January 20.—Supply and delivery of steel towers for 220 K.V. and 132 K.V. Transmission lines, Specification No. 628 for Nangal Power Project. The Chief Engineer, East Punjab P.W.D., Electricity Branch, G.H.Q., South Block, Simla.

BOMBAY: Water Supply.

February 4.—Construction of a cement concrete dam across the river Vaitarna. The dam will be about 1,700 feet long and about 2,500 feet high. The Special Engineer, Bombay Municipality, Bombay.

RESULTS OF TENDERS

Gal Oya Project, Ceylon: Contract signed on November 30, 1948 by a representative of Messrs. Morrison—Knudesan Co. of San Francisco. Value 10 million dollars.

The dam at Gal Oya is to be 154 feet high and more than three-quarter of a mile long and will involve 8½ million cubic yards of excavation. Work will commence in March 1949 and will be completed in 1952.

Closed September 22.—Supply of Battens: Controller of Stores, E.I.R., Calcutta. Offers of Nath & Co. accepted. Rates T.W. battens 3/4" x 3/8" x 7' and upwards per 100 ft. Rs. 4; and 1½" x ½" x 7' and upwards per 100 ft. Rs. 7-8-0.

Closed September 24.—Asphalting Municipal Roads of Ahmednagar: Accepted offers of Hindustan Construction Co. Ltd. Value Rs. 1,66,013.

HOW WAS JANUARY 1948

For Building

Rainfall in inches.

Ahmedabad	2.2
Ahmednagar	0.7
Alleppey	1.1
Ambala	0.5
Aurangabad	0.9
Bangalore	0.5
Baroda	0.2
Belgaum	0.1
Bellary	0.0
Benares	0.1
Bhopal	3.6
Bombay	0.3
Calcutta	0.8
Cherrapunji	0.0
Cocanada	0.0
Cochin	0.5
Cuttack	0.7
Darjeeling	0.1
Dehra Dun	0 0
Delhi	2.3
Gaya	1.0
Gulbarga	0.0
Hanam Konda	0.0
Hanovar	0.3
Hyderabad (Deccan)	0.0
Hyderabad (Sind)	0.0
Jamshedpur	1.0
Kodaikanal	7.5
Kurnool	0.0
Ludhiana	0.4
Madras	2.1
Madura	1.9
Mahableshwar	0.8
Mangalore	1.3
Mercara	0.3
Multan	0.0
Masulipatam	0.0
Mussoorie	0.0
Mysore	0.4
Nellore	1.2
Negapatam	6 3
Ootacamund	2.7
Palghat	1.6
Peshawar	0.1
Poona	1.4
Raichur	0.0
Rajkot	0.1
Ranchi	1.3
Shillong	0.0
Sholapur	0.0
Simla	0.5
Surat	0.1
Trichinopoly	1.1
Trivandrum	1.1
Vizagapatam	0.4

FOR DISCUSSION

If we wish to make our children more intelligent or more energetic, we must know a great deal about the influences that affect intelligence and enthusiasm, and—most important—we must decide which of them we can easily control.

In Czechoslovakia, workers have voluntarily increased their hours and surrendered their holidays to build anew as quickly as possible.

It is a common place of psychology that learning is most easily and most effectively accomplished when the interest is engaged—when the emotional as well as the intellectual needs and drives are taken into account.

Success or failure at school or college supply no standards by which the promise of the future may be estimated.

To be able to reproduce the words of others, or to shuffle mathematical symbols rapidly, may be creditable, but it is not to be compared with the power of originating ideas or devising new solutions to problems.

Geological conditions alone determine the presence or absence of underground water, and when these conditions are precisely known the geologist can state without hesitation what the possibility is of finding water.

The less a man knows, the more content he is with his intellectual capacity and outlook; it requires a great man to realise the imperfections of his knowledge.

So little done, so much to do, should be the first and last thought of every one in this country.

PROPOSED NEW WORKS

Allahabad: The City Improvement Trust, Allahabad, has approved of a scheme to construct in Mohammad Ali Park on the site of the old house of late Pandit Motilal Nehru a room similar to the one in which Pandit Jawaharlal Nehru was born.

Bagalkot: Plans are ready for the construction of an Agricultural School at Bagalkot costing approximately Rs. 3,00,000.

Dharmapuri: The Dharmapuri Co-operative Building Society has acquired 26 acres of lands with a view to constructing 110 houses of class A, B and C. **The Building Information Centre, Madras**, has suggested a panel of two Architects for the preparation of the Scheme.

Ghaziabad: The Municipal Council of Ghaziabad has sanctioned a scheme for the construction of new concrete roads and streets.

Khanna: The foundation stone of the Anglo-Sanskrit College at Khanna was laid by Sir Chandulal Trivedi, the Governor of East Punjab, on November 20.

Madras: The Pachaiyappa's Trust, Madras, has invited tenders for constructing two Hostel Blocks and other connected buildings in the Pachaiyappa's College Grounds at Chetput.

Malabar: The first major irrigation project for Malabar—the Malampuzha Scheme—has been sanctioned by Government. It will cost Rs. 3.8 crores in its first stage.

Patiala: Construction of two townships for refugees, one at Rajpura and the other at Doraha, has, it is learnt, been decided by the Rajpramukh of Patiala. The Government of India have agreed to advance Rs. 2 crores to the Patiala Union for this purpose.

EDUCATIONAL

THE ROYAL INSTITUTE OF CHARTERED SURVEYORS

The training of Surveyors and the practice of valuation in Great Britain are controlled and guided by the Royal Institute of Chartered Surveyors, a corporate body to which these duties have been entrusted by Royal Charter.

The Institute was founded in 1868 to secure the advancement and facilitate the acquisition of that knowledge which constitutes the profession of a Surveyor namely the art of determining the value of all descriptions of landed and house property and of the various interests therein the practice of managing and developing estates and the science of admeasuring and delineating the physical features of the earth.

The foundation of the Institute is its body of members who are of two classes: Fellows (F.R.I.C.S.) and Professional Associates (A.R.I.C.S.). *Before August 1947, these two classes were designated* as F.S.I. and P.A.S.I. There are also other classes of members, namely, Honorary Members, Associates, Students, and Probationers. Thus the Institute promotes the general interest of the profession and maintain and extend its usefulness for the public advantage.

The Institute holds examinations for candidates seeking to be elected as members. By exercising strict discipline in its members the Institute is held at high esteem. All Fellows, Professional Associates and Associates are required within two years after their election to deliver to the Institution an original paper or other work acceptable to its Council on some subject connected with the profession or make a financial contribution to its Library.

A committee of Quantity Surveyors under the aegis of the Institute's Council deal with all questions connected with Quantity Surveyors.

The new President of the Institution is Mr. S. Vyvian Hicks.

Address of the Institute is 12, Great George Street, London, S.W. 1.

TUNNEL CONSTRUCTION

Widening and 'daylighting' of tunnels under normal traffic, which G.I.P. Railway engineers claim have never before been undertaken in India, and only on a few occasions in the world, are being done in the Thull and Bhor Ghat sections of the G.I.P. Railway about 80 miles away from Bombay.

The Project costing Rs. 2 crores includes ten new tunnels of a total length of 9,095 ft. and is expected to be completed by January 1951. The longest of the new tunnels to be constructed is 1,084 ft.

Mr. F. A. Primrose, who was then the Deputy Chief Engineer of the Railway, prepared a scheme of it first in 1926. Further exploratory work was done more recently under Lt.-Col. J. E. Clutterbuck, former Chief Engineer, and Mr. N. M. Thadani, the present Deputy Chief Engineer, and the scheme now being put through resulted from these investigations.

As an example of ghat railway construction, the project is attracting the attention of engineers. Members of the Bombay Centre of the Institution of Engineers (India) are expected to visit the work early in January next, with a view to acquainting themselves with the details of the project.

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The Proprietors of "The Building Gazette" have placed this space at the disposal of the Employment Exchange, Government of India.

The Employment Exchange has on the Register a large number of ex-servicemen of various qualifications, and the Director would be very thankful if Employers would kindly notify to the local office of the Exchange particulars of any vacancy they may have available.

BOOKS ON ENGINEERING

ARCHITECTURE & TOWN PLANNING

O-SERIES

	Rs.	A.	P.
Architecture by Martin S. Briggs ...	3	12	0
Architecture by C. Batley (Oxford Pamphlet) ...	0	6	0
Slide Rule Calculations by H. O. Cooper...	6	6	0
Constructional Steelwork Simply Explained by O. Faber ...	4	8	0
Simple Examples of Reinforced Concrete by O. Faber ...	4	8	0
Reinforced Concrete Simply Explained by O. Faber ...	4	8	0
New Acoustics by N. W. McLachlan ...	5	10	0
Iron and Steel Today by J. Dearden ...	5	10	0
Building Today by M. S. Briggs ...	5	10	0

OL-SERIES

	Rs.	A.	P.
Practical Engineering Problems and Their Solution by Higgs ...	1	0	0
Building Construction by McKay Vols 1, 2 & 3, each ...	7	5	0
Structural Engineering by Cassie ...	13	0	0
Theory of Structures by Morley ...	13	0	0
Building Quantities by Anderson ...	6	1	6
Britain and Her Buildings by Kirkman ...	2	3	9
Strength of Materials by Morley ...	12	3	0
A Residential Unit for Town and Country Planning by Fawcett ...	2	7	0
Town Planning and Road Traffic by Tripp ...	10	15	0
City Planning, Why and How by Lewis...	11	4	0
Plumbing by Winder ...	6	1	6
Men at Work (Industrial Psychology in the Factory) by Oakley ...	6	14	6

M-SERIES.

	Rs.	A.	P.
Building Construction for Beginners by Relly ...	5	4	6
Experimental Building Science by Mason ...	4	14	6

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CURRENT MARKET PRICES OF MATERIALS

1. **Prices vary according to quality and quantity ordered.**
2. **Those given below are average market prices in Madras.**
3. **Owing to the unsettled state of market most prices are liable to fluctuate.**

CONCRETOR

Item	Unit	Rs.	A.	P.
Cement controlled price	per ton	91	7	4
$\frac{3}{4}$" broken granite	per 100 c. ft.	60	0	0
River or pit sand	,,	12	0	0
Reinforcement, mild steel rods, $\frac{5}{8}$" diameter and upwards	per cwt.	17	4	0
Reinforcement, mild steel rods, $\frac{1}{2}$" diameter	per cwt.	17	7	0
Reinforcement, mild steel rods, $\frac{3}{8}$" diameter	per cwt.	18	8	0
Reinforcement, mild steel rods, $\frac{1}{4}$" diameter	per cwt.	21	0	0
Binding wire, 24 gauge	per lb.	0	10	0

BRICKLAYER

Item	Unit	Rs.	A.	P.
Hand-made bricks	per 1,000	32	0	0
Table moulded bricks	per 1,000	60	0	0
Lime	per 100 cft.	90	0	0

ROOFER

Item	Unit	Rs.	A.	P.
Malabar tiles	per 1,000	225	0	0
Malabar ridge tiles	per 1,00	75	0	0
Terrace bricks	per 1,000	20	0	0
Asbestos corrugated sheets	per sq. ft.	0	5	9
Asbestos Trafford sheets	,,	0	6	3
Galvanised corrugated sheets, 24 gauge	per sq. ft.	0	4	3

CARPENTER

Item	Unit	Rs.	A.	P.
Burma teak scantlings	per c. ft.	20	0	0
Malabar ,,	,,	15	0	0
Mango ,,	,,	5	0	0
Insulation boards, $\frac{1}{2}$" thick	per sq. ft.	0	9	0
Asbestos plain, sheets, $\frac{1}{4}$"	,,	0	6	4
,, 5/32"	,,	0	4	0
Wire nails	per lb.	0	12	0
Copper cut tacks	,,	2	8	0
Wood screws, iron: $\frac{3}{8}$"	per gross	1	12	0
1"	,,	2	0	0
$1\frac{1}{2}$"	,,	2	4	0
Bright steel butt hinges: 3"	per pair	0	12	0
4"	,,	1	11	0
Iron hasps and staples	each	1	1	0
Iron All-drops, 12"	,,	3	4	0
Iron tower bolts	per ft.	0	12	0
Brass ,,	,,	4	0	0

GLAZIER

Item	Unit	Rs.	A.	P.
Sheet glass cut to size, ordinary glazing quality, 16 oz.	per sq. ft.	0	10	0
Sheet glass cut to size, ordinary glazing quality, $\frac{1}{8}$"	per sq. ft.	1	2	0
Sheet glass cut to size, ordinary glazing quality, 3/16"	per sq. ft.	2	8	0
Plate glass, $\frac{1}{4}$"	,,	4	0	0
Figured glass, white	,,	0	14	0
,, ,, coloured	,,	1	6	0

IRONWORKER

Item	Unit	Rs.	A.	P.
Rolled steel joists, 4" x 3"	per cwt.	17	2	0
,, 5" x 3" to 15" x 6"	,,	16	12	0
,, 18" x 6" and over	,,	17	2	0
Channels, angles and tees	,,	18	0	0
Mild steel plates	,,	17	0	0
Black sheets, 20 gauge	,,	19	4	0
G.I. plain sheets, 24 gauge	,,	22	10	0
G.I. barbed wire, 2 ply, 12 gauge	per cwt.	39	4	0
Carriage bolts, $1\frac{1}{2}$" to $4\frac{1}{2}$" size— $\frac{1}{4}$"	per gross	7 0 0 to 15 0 0		
$\frac{3}{8}$"	,,	12 0 0 to 25 0 0		
M.S. flat or round head rivets	per cwt.	75	0	0
Steel rolling shutters	per sq. ft.	10	0	0
Collapsible gates	,,	6	0	0

PAVIOR

Item	Unit	Rs.	A.	P.
White glazed tiles, 6" x 6" x 3/16"	per doz.	10	8	0
,, 6" x 6" x $\frac{1}{4}$"	,,	11	8	0
Coloured ,, 6" x 6" x $\frac{1}{4}$"	,,	12	12	0
White or grey marble tiles, $\frac{3}{4}$" thick (unpolished)	per sq. ft.	4	8	0
Terrazzo slabs, polished	,,	1	6	0

PLUMBER

Item	Unit	Rs.	A.	P.
Squatting pans, Indian	18" each	24	0	0
Pedestal closets	,,	55	0	0
W.W.P. cisterns, 3 gal.	,,	40	0	0
Sinks, 30" x 18" x 10"	,,	170	0	0
Wash hand basins with single taps, waste and chain, 25" x 18"	each	140	0	0
Flat urinals, English	,,	60	0	0

PAINTER

Item	Unit	Rs.	A.	P.
Distemper J and N.	per lb.	0	11	6
,, 'Aquatinta' oil bound paste	per lb.	1	1	0
'Neurolac' synthetic enamel.	per gal.	32	0	0
'Goodlass' wall paints	per lb.	0	10	9
Linseed oil	per gal.	9	10	0
Copal varnish	,,	9	8	0
Glue	per lb.	0	15	6

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